

Cansat, Educational Hands-on to Learning about Satellites

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Outline

- Cansat concept
- How it started
- Competitions
- Summer camp
- Cansat kits



What is a Cansat

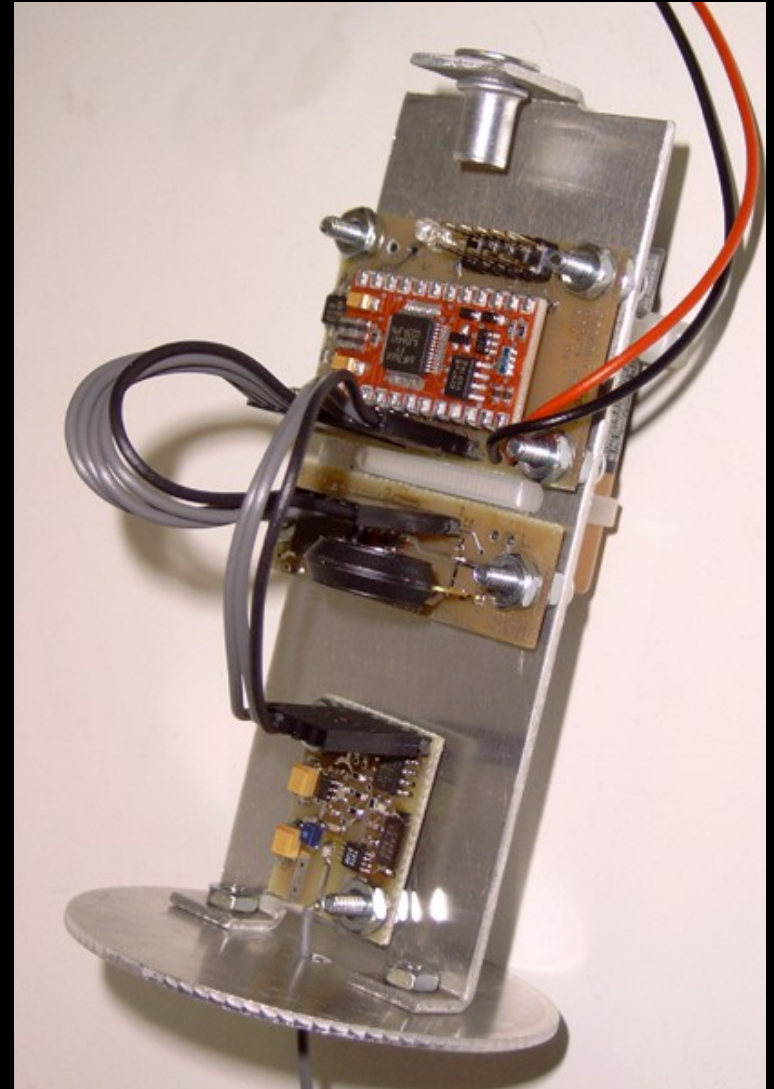
- Simulation of a satellite on a small scale
- Size of a soda can
- Used to expose students to the life cycle of a satellite development program on a small affordable scale
- Contains many of the subsystems found in a real satellite
- Concept developed by Prof. Twiggs from Stanford University

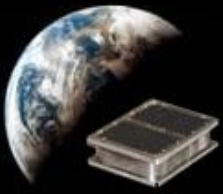




Cansat Concept

- Students design cansat to perform a mission
 - Atmospheric measurements
 - Imaging
 - Navigation
- Cansat to meet specific requirements
 - Cylindrical envelope of soda can dimensions
 - 2.6 inches diameter
 - 5 inches length
 - 350 grams maximum mass
 - No protrusions until deployed





Launching the Cansat

- High power rockets used
 - Altitudes vary from 1K to 12K feet
 - Rockets deploy cansats at apogee
- Cansat floats back to earth via parachute
 - Duration in air simulates satellite pass
- Students collect telemetry from cansat





How it Started

- Concept developed by Prof. Robert Twiggs of Stanford University
- First launch in 1999 in Black Rock, Nevada
- Aeropac rocket club provided rockets to launch cansats
 - Altitude of 12,000 feet
 - Three cansats deployed simultaneously using 6 inch diameter rockets and large M size rocket motors





Cansat Competitions

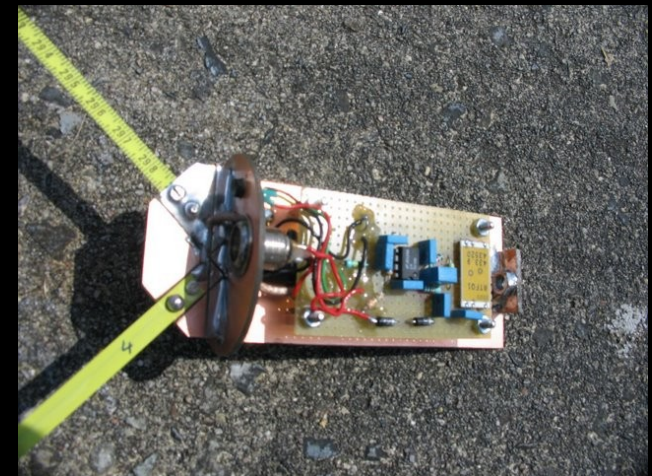
- USA Competition
 - First Cansat Competition
 - Main sponsoring organizations
 - Naval Research Laboratory, Washington DC
 - NASA Goddard, Beltsville, MD
 - NASA JPL, Pasadena, CA
 - First event
 - 2005 launch in El Centro, CA
 - 3 teams attended out of 7 that applied
 - 2006 launch
 - The Plains, VA
 - 7 teams out of 13 attended
 - 2007 launch
 - 15 teams out of 26 attended





Netherlands Join the Cansat Craze

- Organized jointly by Delft University and Innovative Solutions in Space Company
 - Pilot competition had 6 teams from 5 schools
 - Used cansat kits and added secondary sensors
 - Aerosol detection
 - Camera
 - GPS
 - Steerable rogallo wing
 - Inflatable air cushion for landing
 - Power generation using a computer fan to power an LED and detect it in flight using an LDR





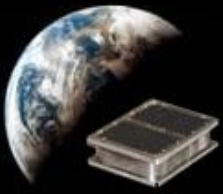
Netherlands Cansat Competition





Current Status Of Netherlands Cansat Program

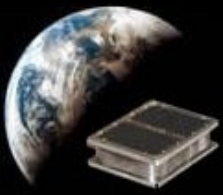
- Competition is expanding this year
 - 36 teams confirmed for event
 - Expecting up to 50 to sign up by Nov 5.
- Netherlands bought 60 cansat kits to distribute to high schools
- Winner of competition will get a trip to the US competition



High School Cansat Event

- Starts Now!
- Applications due by October 31
- Launch in Eastern Shore, MD
 - Launch run by Maryland/Delaware Rocketry Association
- Launch Date April 2008
- <http://members.cox.net/igalysh>





High School Cansat Event

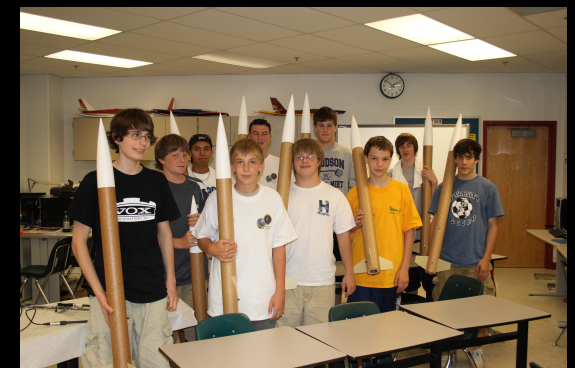
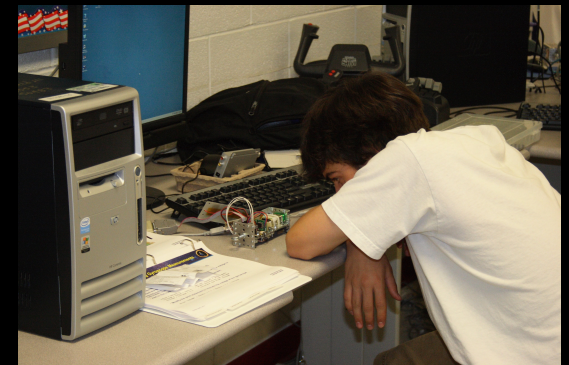
- Students design cansat, rocket, and ground station
- Mission
 - Atmospheric measurements
 - Maximum acceleration detection
 - Transmit telemetry at 5 second interval or faster
 - 1500 foot altitude minimum





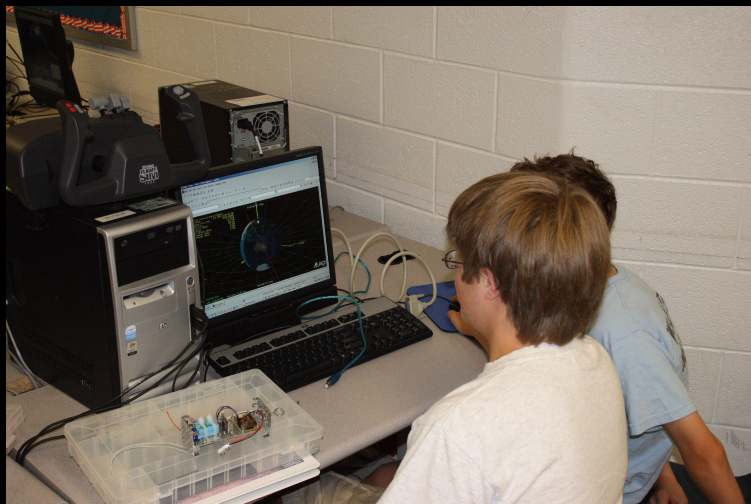
Cansat Summer Camp

- Sponsored by Federation of Galaxy Explorers
 - www.foge.org
 - Nonprofit organization that teaches kids from grades 3-12 space exploration
- One week program for 9-12th graders
 - Assemble and program cansat kits
 - Build rocket to launch cansats
 - Learn about orbits using Satellite Tool Kit software
 - Learn about attitude sensing using real sensors
 - Gyroscopes
 - Magnetometers
 - Test cansats with ground station
 - Launch cansats





Cansat Summer Camp





Cansat Kits

- First commercially available cansat kit

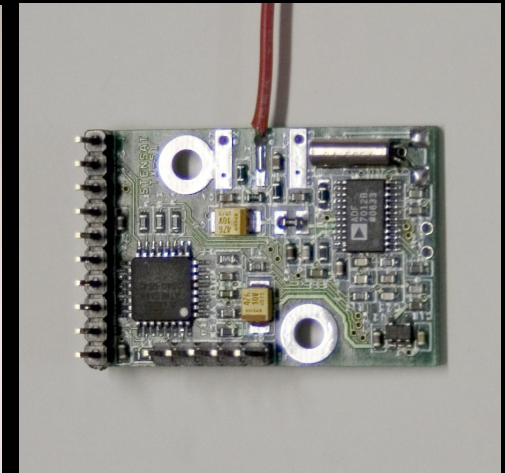
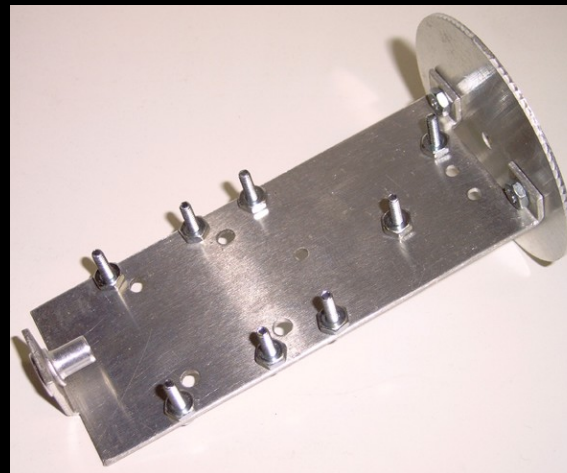
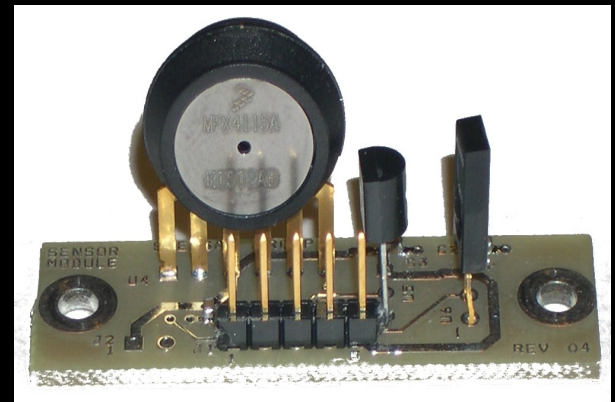
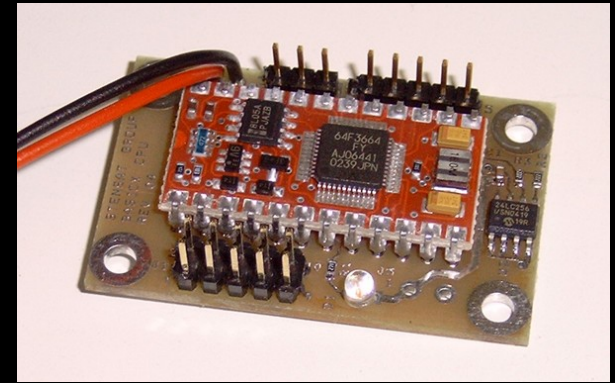
- Performs atmospheric mission

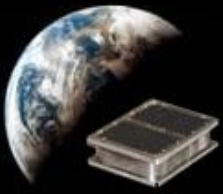
- Air pressure sensor
- Temperature sensor
- Humidity sensor

- Subsystems included

- Data handling unit
- Transmitter
- Structure
- Parachute
- Battery
- Sensor payload

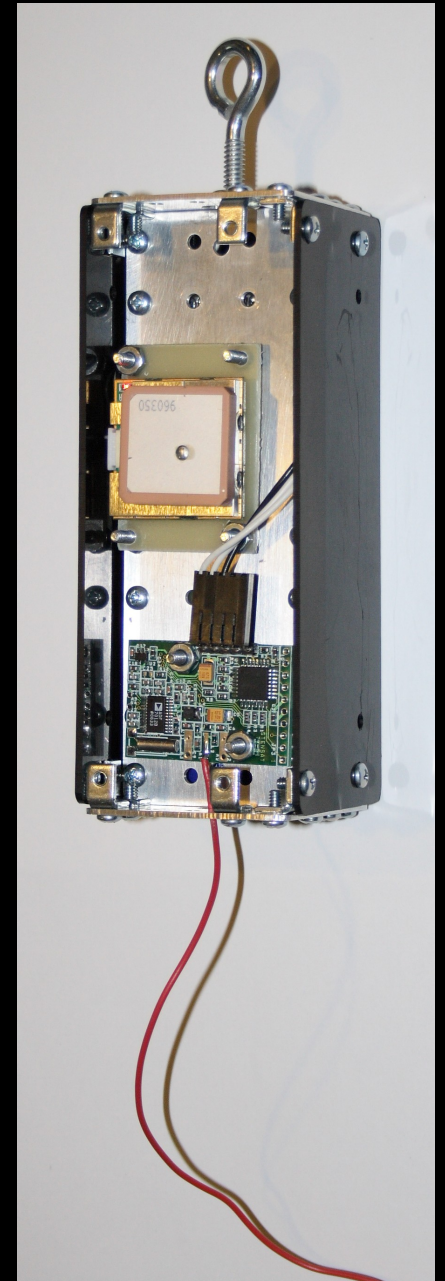
- Programmed in BASIC





New Cansat Kit

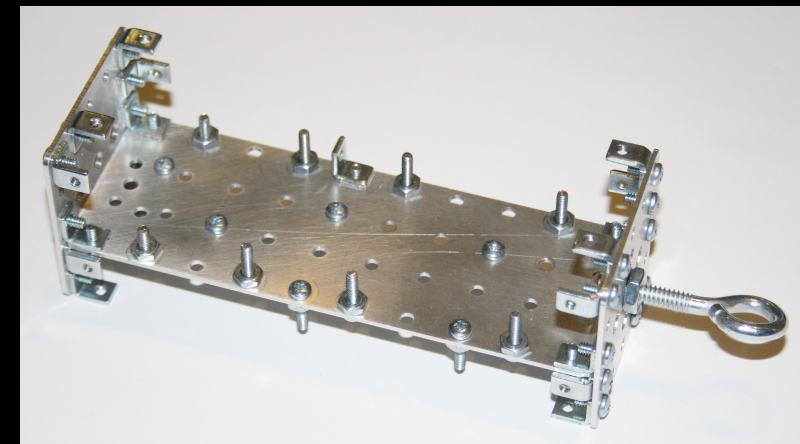
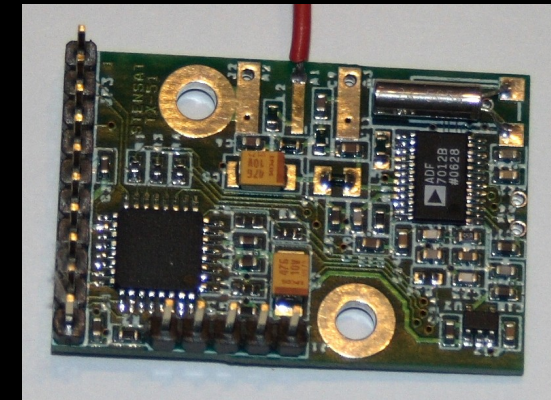
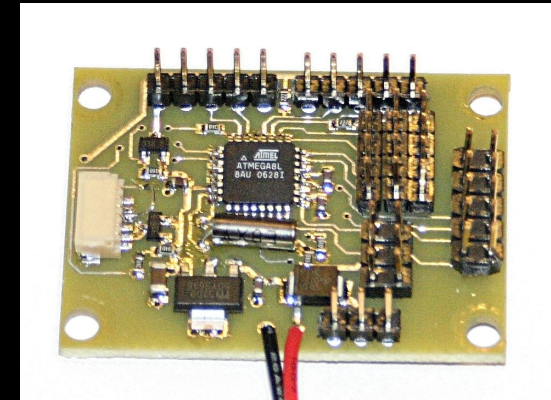
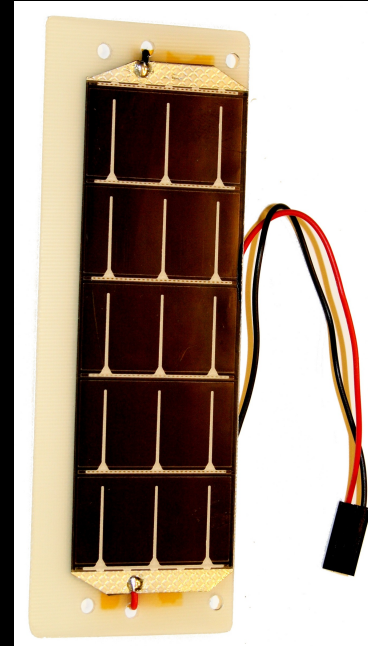
- Tossed the can
- Designed to be a developers kit
- Box shaped
 - Provides external flat surfaces
 - Mount solar panels
 - Integrate sensors
- Uses Atmega8 microcontroller
 - Free compilers in C and BASIC
- Transmitter
 - 1200 and 9600 baud operation
 - AX.25 protocol
 - 70cm and 900 Mhz ISM bands
- Operates on 9 volt battery





Cansat Kit Components

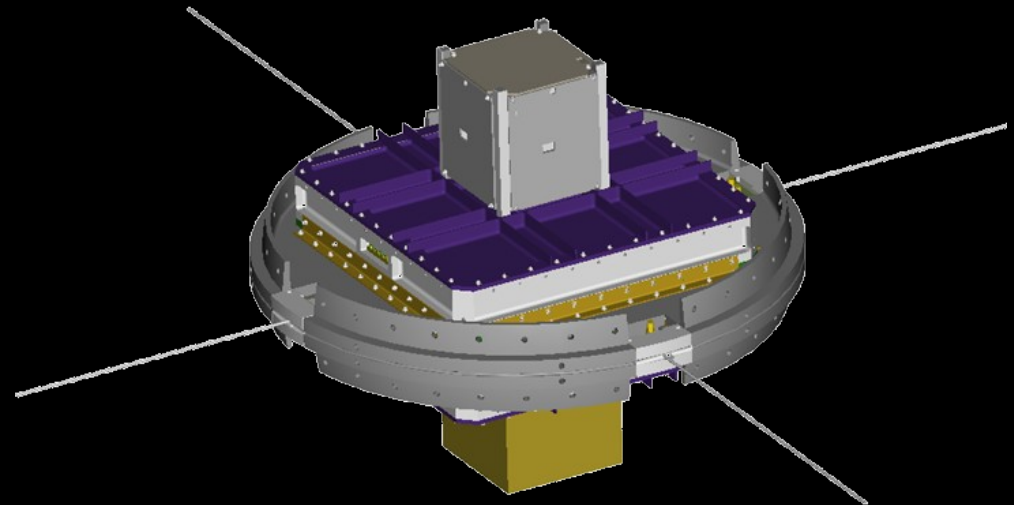
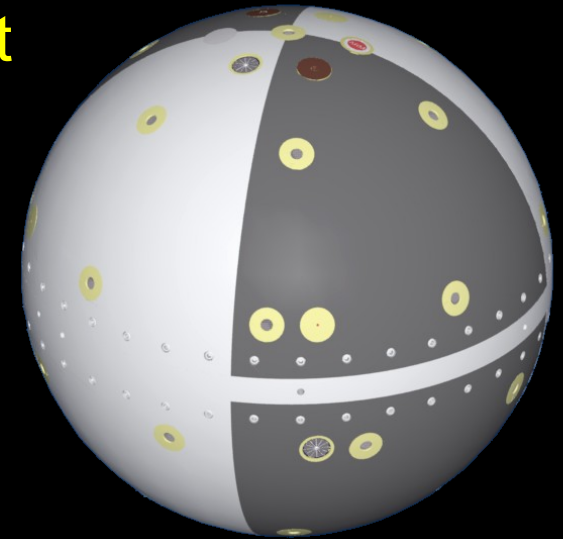
- Processor
 - Atmega8
 - 4 ADC channels available
 - UART
 - I2C
 - Solar panel connection for battery charging
- Transmitter
 - AX.25 protocol
 - 1200 baud AFSK
 - 9600 baud FSK
 - Up to 10 mW
 - Used in actual flight hardware
- Flexible structure
 - Allows for different configurations





Other Activities

- Students participation in satellite development
 - Naval Research Lab developing satellites for atmospheric drag experiment
 - Two spherical satellites to be deployed
 - CASTOR and POLLUX
 - Multiple student teams involved in POLLUX development
 - One team performs systems engineering and integration
 - Other teams develop payloads
 - MEMS sensor payloads





Conclusion

- Cansat is a great teaching tool
 - Teaches students about satellite design and operations
 - Teaches about space programs
 - Cansats can be flown in small and large rockets on small and large fields